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PRESERVING BIODIVERSITY OF CULTIVATED VEGETABLE SPECIES IN CROATIA

ZAŠTITA BIOLOŠKE RAZNOLIKOSTI KULTIVIRANIH VRSTA POVRĆA U HRVATSKOJ

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ABSTRACT

Thanks to diverse climatic and soil conditions as a long tradition in vegetable growing in Croatia, numerous valuable eco-populations and domestic vegetable varieties have been created. Due to technological development in vegetable production, introduction of foreign hybrid varieties and degradation of domestic vegetable seed industry, a lot of Croatian vegetable gene stock are permanently lost and many are endangered. Aiming to preserve vegetable plant genetic resources and biodiversity over the last three years, seed of the most endangered Croatian domestic vegetable populations and varieties have been collected, and after valorization in the collection field at Križevci College of Agriculture will be prepared for long term conservation in the National Gene Bank. Collection of the seed from local domestic vegetable population by school children in the Koprivnica-Križevci County, as a pilot project acceptable in other parts of Croatia, was done during the spring 2007. The total amount of 9.536 samples from all parts of the county was collected.

In another project 94 populations of local kale (*Brassica oleracea* var. *acephala)* from eastern Adriatic coastal region were collected and planted at the collection field of the Institute for Adriatic Crops and Karst Reclamation in Split. Description, characterization, valorization and regeneration were made during vegetation.

Preserving local vegetable populations is an important process for conservation of biodiversity and build-up of genetic material suitable for organic agriculture development.

Key words: vegetable, old varieties, eco population, preservation

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SAŽETAK

Zahvaljujući različitosti klimatskih i zemljišnih uvjeta te dugoj tradiciji uzgoja u Hrvatskoj je stvoren velik broj iznimno vrijednih eko populacija i domaćih sorti povrća. Razvojem tehnologija proizvodnje, uvođenjem hibridnog sjemena introduciranih stranih sorti u proizvodnju te postupnim gašenjem organizirane domaće proizvodnje sjemena povrća značajan dio hrvatskog genfonda povrća je trajno izgubljen, a velikom dijelu to prijeti.

U svrhu zaštite biljnih genetskih resursa povrtnih kultura i očuvanja biološke raznolikosti tijekom protekle tri godine sakupljano je sjeme i sadni materijal od trajnog nestajanja najugroženijih hrvatskih domaćih sorti i populacija povrća. Taj će materijal nakon valorizacije na kolekcijskom polju Visokog gospodarskog učilišta u Križevcima biti pripremljen za dugoročno čuvanje u Nacionalnoj banci biljnih gena.

Tijekom proljeća 2007. godine na području Koprivničko – križevačke županije u svim osnovnim i srednjim školama pokrenut je pilot projekt prikupljanja sjemena i sadnog materijala domaćih lokalnih populacija povrća u koji je bio uključen velik broj školske djece. Tijekom dvotjednog prikupljanja ukupno je sakupljeno 9.536 uzoraka sjemena i sadnog materijala iz svih dijelova županije. Valorizacija prikupljenog materijala je u tijeku nakon čega će najvrjedniji biti regeneriran i pripremljen za dugoročno čuvanje.

U drugom projektu s područja istočno-jadranske obale prikupljena su 94 uzorka sjemena populacija raštike (*Brassica oleracea* var. *acephala*) koji su posijani u kolekcijskom polju Instituta za jadranske kulture i melioraciju krša u Splitu. Nakon opisa, karakterizacije, valorizacije i regeneracije dobiveno će se sjeme pripremiti za trajno čuvanje.

Zaštita lokalnih populacija povrća značajan je proces očuvanja biološke raznolikosti i osnova za stvaranje genetskog materijala pogodnog za razvoj ekološke poljoprivrede.

Ključne riječi: povrće, stare sorte, eko populacije, zaštita

INTRODUCTON

Climatic and soil diversity of Croatia as well as long term tradition in vegetable growing were the reasons for participation in the production of a large number of varieties and eco-populations of the vegetables of different characteristics. By human migrations, trade and exchanges the seeds of different vegetable crops came to different parts of the country, and only those that adapted best to local conditions, and kept satisfactory yield and quality, were used for further reproduction. By spontaneous crossing, natural selection under the environmental influence, in many parts of our country numerous valuable eco vegetable populations were created.

By increased commercialization of the vegetable production, by disappearance of traditional farm gardens and depopulation of the rural areas, the genetic fund and biological diversity of vegetables in Croatia are especially in danger of permanent disappearance. Unlike other cultural and spiritual heritage that, if not taken care of systematically, decays slowly, biological heritage decays rapidly and once lost, is impossible to reconstruct it a variety or eco population. That is the reason that many nations with developed social awareness established national banks of vegetable genes long time ago, where most endangered varieties and vegetable species are preserved from permanent disappearance.

In Croatia, although known for many years that many valuable domestic varieties and eco-populations have disappeared, and a great number is threatened to, only recently a Committee for plant genetic resource protection was formed, with a priority task of implementation of the National preservation, protection and sustainable exploitation of vegetable genetic resources program. The national program includes establishment of vegetable genes bank that will take a systematic care of collecting, identifying, regenerating and protecting from permanent loss endangered species and vegetable populations.

Within the program on the national level working groups were formed for particular plant species, with a task of creating protection priorities, identifying the most endangered varieties, regenerating them and preparing the seeds to be deposited in the plant gene bank.

The working group for vegetables, made up of almost all leading Croatian scientists and experts dealing with vegetable growing from Faculty of Agricultural in Zagreb, Faculty of Agricultural in Osijek, Križevci College of Agriculture, Institute for Adriatic Crops and Karst Reclamation in Split, Institute for Agriculture and Tourism in Poreč, Vegetable Center in Zagreb and Podravka from Koprivnica drew up on inventory of the existing situation in breeding and seed production of vegetable crops in the Republic of Croatia, determined priorities in preservation and protection of old domestic varieties and eco population of vegetables and started several local and national programs.

CROATIAN BREEDING AND SEED PRODUCTION OF THE VEGETABLE CULTIVARS

In the past as well as today no special attention has been given to breeding vegetables, contrary to significant results achieved in crops breeding. Since 1964, when the first Croatian domestic vegetable variety was bred, only 15 newly created domestic varieties have been registered. (Table 1).

All those varieties came as a result of more or less voluntary selection work because Croatia has never had a serious breeding selection program on vegetables, or a specialized institution that would systematically deal with it. Some domestic newly created vegetable varieties like tomato Zagrebačka rana (Photo 1), Kutjevački rani beans (Photo 2), parsnip Podravkin bijeli (Photo 3) or pepper Botinečka žuta (Photo 4) in former times were widely spread varieties in production, but only some of them have remained. Unfortunately, a part of them are irretrievably lost due to commercial indifference of domestic seed companies for maintaining and production of their seed.

Old domestic varieties and eco-populations of vegetables are also a significant biological inheritance, created by natural selection in specific agro-ecological conditions. Such ecotypes were kept at family farms through many generations. Because of improper import of, by price, competitive foreign seed, domestic vegetable seed production in whose structure domestic varieties and eco-populations prevail has almost completely disappeared. Wide offer of cheaper imported vegetable seeds has drastically decreased interest in keeping and multiplying domestic varieties, especially with numerous housewives that for years had kept varieties that in their natural conditions gave the best results.

Table 1. Newly created domestic vegetable cultivars in the Republic of Croatia

Species	Cultivar	Year of registration	Applicant
Bush bean	Poboljšana indijana	1964	Department of Vegetable Crops Faculty of Agriculture in Zagreb
Tomato	Zagrebačka rana	1967	Department of Vegetable Crops Faculty of Agriculture in Zagreb
Lettuce	Zagrebačka kristal - ljetna	1971	Department of Vegetable Crops Faculty of Agriculture in Zagreb
Bean	Kutjevački rani	1981	PPK Kutjevo
Parsnip	Podravkin bijeli	1981	Podravka Koprivnica
Pepper	Botinečka žuta	1984	Department of Vegetable Crops Faculty of Agriculture in Zagreb
Lettuce	Posavka	1984	Department of Vegetable Crops Faculty of Agriculture in Zagreb
Lettuce	Vegorka	1984	Department of Vegetable Crops Faculty of Agriculture in Zagreb
Pepper	Viza	1990	Department of Vegetable Crops Faculty of Agriculture in Zagreb
Pepper	Majkovačka žuta	1993	Vegetable growing center in Zagreb
Cabbage	Vranski 12	1997	Department of Vegetable Crops Faculty of Agriculture in Zagreb
Bean	Maksimirski	2003	Department of Vegetable Crops Faculty of Agriculture in Zagreb
Bean	Alida	2003	Department of Vegetable Crops Faculty of Agriculture in Zagreb
Bean	Kristina	2004	Department of Vegetable Crops Faculty of Agriculture in Zagreb

Photo 1. Newly created domestic variety tomato Zagrebačka rana

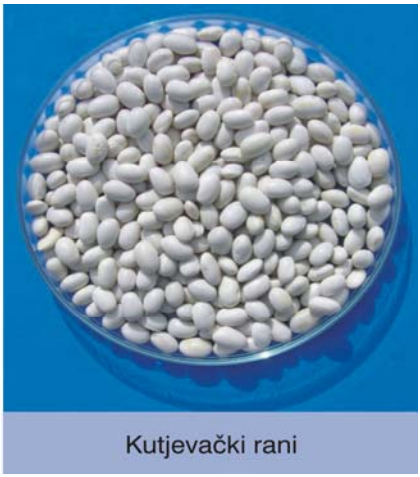

Photo 2. Newly created domestic variety of bean Kutjevački rani

As late as five years ago in Croatia over 300 ha were under seed crops of vegetables with the production of about 500 tons of seeds. In 2007 areas under seed crops of vegetables were three times smaller and produced only about 100 tons of seeds (Chart 1 and 2). In seeds production five years ago there were about 20 cultivars, while in 2007 there were only five.

Photo 3. Newly created domestic parsnip cultivar Podravkin bijeli

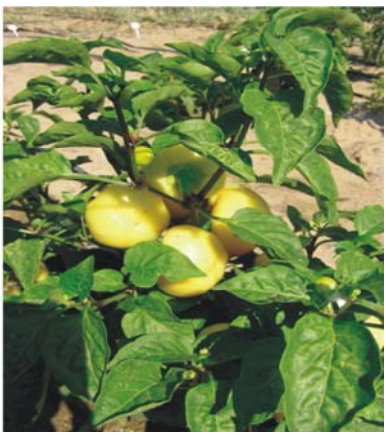

Photo 4. Newly created domestic pepper cultivar Botinečka žuta

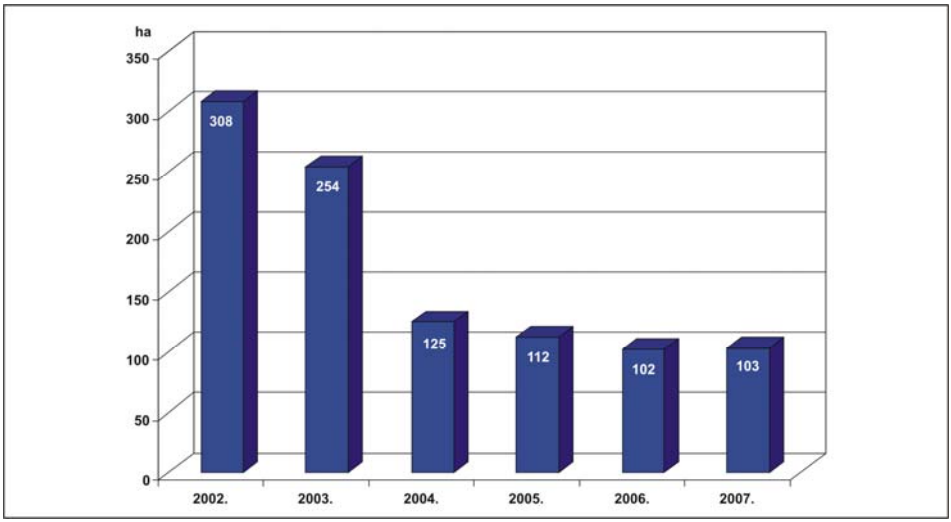

Chart 1. Areas of vegetable seed production in Croatia 2002–2007

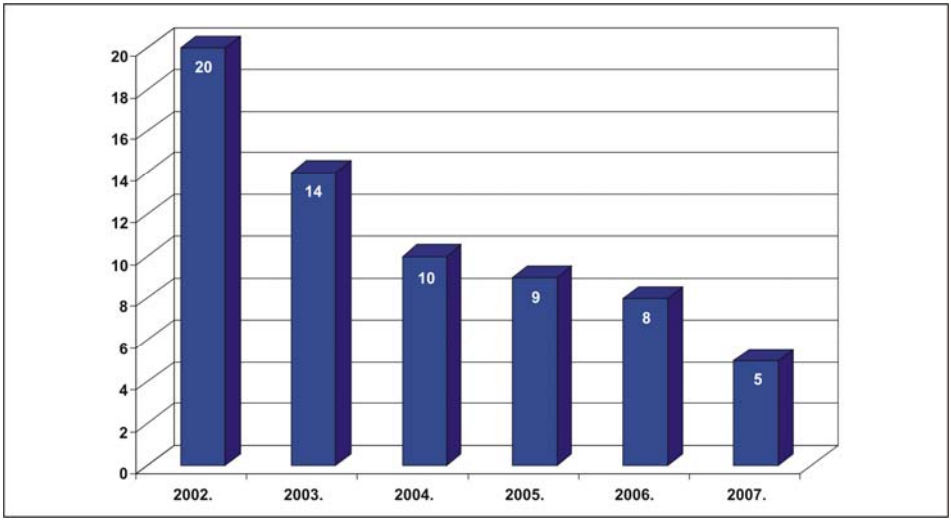

Chart 2. Number of vegetable cultivars in seed production: Croatia 2002–2007

Thanks to different climate and soil conditions Croatia has exceptionally convenient conditions for development of vegetable seed production. Costal areas of Istria and middle Dalmatia are almost ideal for seed production of biennial vegetable varieties such as cabbage, root vegetables, beetroot and Swiss chard. (Photo 5) Due to mild climate, winter survival is possible and at the same time temperatures are low enough to enable transition of the plants to generative phase. Also, in those areas, warm and dry summer enables good ripening of the seeds providing its high quality. In the past, seed production of biennial vegetable species in that area was extremely developed and large quantities of the seeds were exported. Areas of Slavonija and Podravina are suitable for growing annual species of vegetables such as pea, bean, spinach, pepper, and many others whose seeds in that area were even recently produced in significant quantities (Photo 6).

Revitalization of vegetable seed production would diminish dependence on its import, it would increase diversification of rural production, and for a part of especially small family farms a new production programs would enable existence in forthcoming competition that will become more intense in agricultural production after joining the European Union.

Photo 5. Seed crop of cabbage in Istra

Photo 6. Seed crop of pea in Požega valley

ACTIVITIES OF THE WORKING GROUP FOR VEGETABLES

Almost all leading Croatian scientists and experts for vegetables are members of the working group for vegetables. The priorities of the group are preservation and protection of the old domestic varieties and eco-populations whose seeds are listed in the Croatian variety list, but are not commercialized. (Table 2)

Table 2. Especially endangered old domestic vegetable varieties and eco-populations

Species	Varieties	Species	Varieties
Artichoke	Domaća	Garlic	Slavonski ozimi
Cauliflower	Trogirska rana	Garlic	Domaći ozimi
Cauliflower	Trogirska srednje rana	Garlic	Petrinjski ozimi
Endive	Dalmatinska kopica	Garlic	Polački ozimi
Shallot	Domaći	Carrot	Domaća žuta
Cabbage	Ogulinski	Pepper	Feferoni crveni
Cabbage	Cerski	Pepper	Feferoni slatki zeleni
Cabbage	Ćepinski	Pepper	Feferoni slatki žuti
Cabbage	Brgutski	Pepper	Feferoni žuti
Cabbage	Varaždinski kupus	Eggplant	Domaći plavi
Watermelon	Vukovarska lubenica	Parsley	Domaći lišćar
Onion	Istarski ljubičasti	Turnip	Varaždinska repa
Onion	Istarski žuti	Rhubarb	Zagrebačka rabarbara
Onion	Rapski žuti pogačar	Kale	Domaća
Onion	Turopoljski	Lettuce	Dalmatinska ledenka
Garlic	Domaći jari	Lettuce	Kristal ljetna žuta

Members of the working group for vegetables during 2006 and 2007 managed to collect most of the varieties and eco populations from the priority list. Collected seeds and reproductive material were planted in a joint field of the Križevci College of Agriculture. During vegetation a description, characterization and evaluation of collected materials were performed (Photo 7.).

Photo 7. Joint field of collected seeds and planting materials at Križevci College of Agriculture

Thirty-five samples of declared name were determined and seeds or reproductive materials were regenerated for permanent storage in the active collection at Križevci College of Agriculture and in the National Plant Gene Bank. Information on collected and processed samples was entered into the Croatian Plant Genetic Resources Database (CPGRD) and is available at http://cpgrd.agr.hr. For the materials that could not be collected and for samples that could not be determined the activity of collection, description, characterization and evaluation will continue.

THE PROJECT OF STUDENTS COLLECTING OF OLD DOMESTIC VEGETABLE VARIETIES SEEDS IN THE AREA OF KOPRIVNICA – KRIŽEVCI COUNTY

During the spring of 2007 a pilot project started, with the children of all primary and secondary schools in the area Koprivnica-Križevci County collecting seeds of old domestic vegetable varieties. After getting all necessary permissions for hiring the children in carrying out the project and agreements with the school directors, in every classroom involved in the project a display was presented with explanations:

a) why and which of the old vegetable varieties were especially endangered to permanently disappear,

b) how to collect the seeds and what would be done with them.

Each schoolchild received leaflets for the parents, neighbors and relatives with basic information on the project and bags for collecting the seeds and reproductive materials with data that should be written down for every sample. During two weeks of collection total of 2.574 children from 24 primary and 7 secondary schools of Koprivnica–Križevci County actively participated. 9 536 seed samples and reproductive materials were collected of the 16 vegetable species. Most of the samples were beans 3 304, lettuce 996, peppers 802 and onions 766 (Photo 8).

Collected reproductive materials that reproduce vegetative by (onions, shallots and garlic) were planted immediately after registering passport data in the collective field at Križevci College of Agriculture. During vegetation the planted material was described and valorized and the most valuable set apart for permanent keeping. After identification, the seeds of collected accessions of duplicates were prepared for sowing and mostly sowed in spring 2008. The most valuable samples were regenerated and kept in active collection and the research work on it continues. Positive experience from this pilot project will be applied in the next years and in the other counties. Except for the great value of the collected materials the project is significant in raising awareness of young population about needs for preservation of biological diversity.

Photo 8. A part of bean collections from Koprivnica–Križevci County area

COLLECTION, CHARACTERIZATION AND REGENERATION OF LOCAL POPULATION OF KALE (*Brassica oleracea* var. *acephala*) IN THE EASTERN ADRIATIC COAST AREA

With Croatia, in the regional project of collection, characterization and regeneration of local eco-population of kale of the eastern Adriatic coastal area, Bosnia and Herzegovina and Montenegro were involved. A type of kale grown in the eastern Adriatic coastal area and islands is unique by its morphological and biological characteristics. As an extensive vegetable species it is grown exclusively by households and is reproduced by self produced seed that is certainly the reason for great biological diversity. In commercial sense kale is not an economically significant vegetable, there are no selected varieties and the seed can not be found in stores. By depopulation of rural areas a valuable biological diversity is lost, and by this project it is attempted to be kept.

From the eastern Adriatic area from Istria in the north to Montenegro in the south about a hundred accessions of kale were collected and sowed at the Institute for Adriatic Crops and Karst Reclamation in Split (Photo 10). During vegetation the accessions were described and their economic characteristics evaluated performed. The most valuable accessions were regenerated and their seed prepared to be kept permanently at the National Plant Gene Bank (Photo 11).

Photo 9. Collection field of kale at the Institute for Adriatic Crops and Karst Reclamation in Split

Photo 10. Regeneration of selected samples of kale at the Institute for Adriatic Crops and Karst Reclamation in Split

CONCLUSION

By commercialization of the vegetable production, by disappearance of traditional farm gardens and depopulation of rural areas, the biological diversity of vegetable varieties grown in Croatia is extremely diminished, and a large number of local eco-populations and old domestic vegetable varieties are in danger of permanent disappearance. With the purpose of keeping the plant genetic diversity of the vegetable varieties a Working group for vegetable at the Committee for protection of plant genetic resources was established with a priority task of carrying out the National program of preservation, protection and sustainable use the plant genetic resources by collection, identification, regeneration and preservation from permanent loss the endangered species and vegetable populations. In last two years the Working group for vegetable has managed to collect, identify, describe and regenerate 35 most endangered local vegetable species and eco–populations. They prepare the seed and reproductive material for permanent keeping in the active collection at Križevci College of Agriculture and at the National Plant Gene Bank in Osijek. By the project of collecting the seed and propagating material of old domestic vegetable varieties and eco-populations an extremely large biological diversity has been protected. By regional projects in cooperation with Bosnia and Herzegovina and Montenegro a total of about a hundred local populations of kale were collected, 20 of which of the biggest biological diversity were regenerated and preserved from being permanently lost.

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